Cactoblastis cactorum in the USA: a general overview and history

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The cactus moth, *Cactoblastis cactorum* (Berg) (Lepidoptera: Pyralidae), is an exotic invasive pest in the United States that threatens native *Opuntia* cacti. Taxonomically it belongs to the Family Pyralidae and Subfamily Phycitinae. It is native to South America, where there are five species described in the genus. The life cycle consists of an egg stage, which lasts 25-30 days depending on temperature, five larval instars requiring 30-35 days to mature, a pupal stage lasting 15-20 days, and adults, which only live 5-10 days. Females oviposit by stacking eggs one on top of another to form an egg-stick of 50-80 eggs. Egg-sticks are typically attached to cactus spines or the surface of cactus pads. A female may lay 2-3 egg-sticks in her life time. The eggs comprising an individual egg-stick hatch synchronously and the neonate larvae work together to open a hole and burrow into a cactus pad. The larvae are gregarious feeders and completely hollow-out infested pads before moving to adjacent pads, causing damaged pads and eventually the entire plant to collapse. Nearly all pad-forming *Opuntia (Platyopuntia)* are at risk to attack by *C. cactorum*; cholla *Opuntia (Cylindropuntia)* are not preferred hosts.

Cactoblastis cactorum was initially studied and regarded as a very successful biological control agent of invasive exotic *Opuntia* cacti, which were moved around the world for production of fruit, forage and the cochineal scale for cochineal red dye production. Based on the success of the moth in controlling invasive cacti in Australia and South Africa in the 1930's, it was eventually introduced into the Caribbean in 1957 to manage weedy native cactus species. The moth gradually spread throughout the Caribbean Islands and was first detected in south Florida on Big Pine Key in 1989, where it quickly began spreading up the Gulf and Atlantic Coasts. By 1993 it had nearly reached Tampa and Orlando, FL, and scientists at the University of South Florida and the Nature Conservancy began raising concerns about its impact in Florida and its continued spread.

An initial workshop of assessment and planning to address the growing concerns about *C. cactorum* was held in Tampa, FL, in September 2000. Workshop participants unanimously agreed that the moth has the potential to have serious impacts on the ecology of desert environments and on the agricultural and horticultural uses of *Opuntia* in the USA and Mexico. As an outcome of this meeting, USDA-ARS and USDA-APHIS scientists initiated studies to develop management strategies based on the sterile insect technique (SIT). In 2001, irradiation protocols were developed for sterilizing male and female cactus moths and work was initiated by ARS to identify the female sex pheromone to aid in survey and detection efforts. In 2002, the Department of Technical Co-operation of the International Atomic Energy Agency and the Joint FAO/IAEA Division of Nuclear Applications in Food & Agriculture, Vienna, Austria hosted a International Consultant's meeting to assess the Regional importance of *C. cactorum* and in December 2002, APHIS-PPQ recommended that Emergency and Domestic Programs develop a strategic plan to manage the cactus moth in the USA. In 2003, field studies showed that *C. cactorum* mating activities occur for less than one hour each day approximately one hour before sunrise, field cage studies indicated that over flooding ratios of wild to sterile moths as low as 5:1 could significantly reduce population growth, and a second planning meeting sponsored by APHIS-PPQ was held in Miami, FL, to discuss current pest status, research needs and the

drafting of a strategic plan. In 2004, APHIS-PPQ hosted a meeting in Pensacola, FL, to develop survey plans for tracking infested/non-infested cactus on US public and private lands, a white paper was completed on the potential economic impacts of *C. cactorum* in the USA, and Mexico hosted a Regional Forum in Mexico City on prevention and preparedness activities. Based in the detection of *C. cactorum* at Dauphin Island, AL, USDA-APHIS and ARS approve funding ($65,000 each) to initiate SIT field validation studies. In 2005, SIT field studies are begun and APHIS-PPQ and SAGARPA each approve approximately $500,000 for fiscal year 2006 to cooperate in developing eradication/management tools and strategies to slow the spread of the cactus moth. Transfer of the funds from Mexico to the USA is facilitated by NAPPO. In 2006, SIT validation studies are completed. Based on its apparent success, APHIS-PPQ begins transitioning to an implementation program and a field office is opened in Pensacola, FL. SAGARPA reports detection of *C. cactorum* on Isla Mujeres, Quintana Roo, near Cancun and begins eradication efforts. APHIS-PPQ and SAGARPA renew joint funding for FY07. In 2007, the cactus moth appears to be eradicated from Dauphin Island, AL and clean-up and release efforts focus on Little Dauphin Island and Ft. Morgan, AL to the East. In Mexico, eradication efforts on Isla Mujeres make significant progress, but a small new infestation is detected on nearby Isla Contoy.